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## How Power BI can be Built to Analyze Player and Team Statistics in the NBA

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# **How can Power BI be Built to Analyze Player and Team Statistics in the NBA?**

By

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First Advisor

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A thesis submitted in partial fulfillment of the requirements for the Honors program

Degree in Bachelors of Science in Business Administrations with concentrations in Supply Chain  
Management, Marketing and Management

Department of Management

at the

University of Nebraska at Omaha

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## **ABSTRACT**

Software is evolving every day to aid the work of what was once manual and monotonous tasks (Software Engineers). One of these platforms is Power BI, a product made by Microsoft. Power BI is a business analytics software that can provide visualization for data that is created through reports or dashboards. My thesis used the Power BI software to answer the question “How Power BI can be built to show player and team stats for the NBA.” In this project, I researched and developed a tutorial on how to use Power BI to build a report using historical statistics of NBA players as an example. The tutorial I created thus provides a guide on how to build a dashboard with other sets of data. Working with this software prior to this thesis, I found it difficult to understand all the functionalities the platform had to offer. After conducting extensive research, I was able to make a guide for individuals who are just beginning to learn how Power BI can help them visualize data spreadsheets in the work they do with ease.

## INTRODUCTION

Power BI is a data visualization software that can be shared across organizations (What is Power BI), making it a powerful tool that can be used for a multitude of reasons. With the ability to be fully automated and interactive, users can save time and resources for tasks of all sizes that would have previously be done manually (SOURCE?). Power BI has the ability to show different level views on how an organization is running, what gain and pain points they have, and live stats to update an organization's internal or external stakeholders. All of this is presented in a visually appealing way compared to rows and rows of numbers in an excel file.

The software comes in two forms; the desktop version and web version. This guide will walk users through step by step simple instructions on how to build a dashboard in the desktop version. Additionally, this guide also includes instructions on how to publish the dashboard to the web version so that it can be shared with others.

Power BI has multiple complexities to take apart every number in a dataset. This guide is simply a beginner guide for first time users to get a better understanding of how well this product can work for a project they are working on to better the organization they are in.

To better explain how to build a dashboard, screenshots are taken from a dashboard built analyzing team and player stats from the NBA from 1950 to the present. This dashboard was built in congruence with the formation of this guide to make sure all basic functionalities are explained to new dashboard builders. See Figures 1-4 below for screenshots of the guided dashboard which display the end result, I will then walk through the process of how the dashboard was built.

To start, filter to a 5 year period and/or select your team.

Year/Date  
1/1/1990 1/1/2017

Team

Player

A.C. Green	Star Rasmussen	Chris Owens
A.J. Bramlett	Blake Ahearn	Chris Paul
A.J. English	Blake Griffin	Chris Porter
A.J. Guyton	Blue Edwards	Chris Quinn
A.J. Hammons	Bo Ellis	Chris Richard
A.J. Price	Bo Enas	Chris Robinson
A.J. Wynder	Bo Kimble	Chris Singleton
A.W. Holt	Bo Lamar	Chris Smith
Aaron Brooks	<b>Bo Outlaw</b>	Chris Taft
Aaron Gordon	Bob Allen	Chris Washburn
Aaron Gray	Bob Anderegg	Chris Webber
Aaron Harrison	Bob Armstrong	Chris Weir
Aaron James	Bob Anzen	Chris Whitney
Aaron McKie	Bob Bigelow	Chris Wilcox
Aaron Miles	Bob Boozer	Chris Wright
Aaron Swinson	Bob Brannum	Christian Eyenga
Aaron Williams	Bob Brown	Christian Laethner
Abdul Jeesani	Bob Burrow	Christian Wood
Acie Earl	Bob Carney	Chubby Cox
Acie Law	Bob Carpenter	Chuck Aleksinas
Adam Harrington	Bob Carrington	Chuck Cooper
Adam Keefe	Bob Christian	Chuck Gilmur
Adam Morrison	Bob Cousy	Chuck Grigaty

Figure 1. Filter Tab



Figure 2. Overview Tab



Figure 3. Offensive Tab



Figure 4. Defensive Tab



## **STEP-BY-STEP GUIDE**

### **Purchasing**

To first understand how to run Power BI, the user will need to download and pay for the product. The Power BI software is \$9.99 a month per user for the Pro version and to add the Premium version, it is \$4,995 a month per dedicated cloud compute and storage resources with an annual subscription. There are some substantial differences with the Pro and Premium products. The biggest differences between the versions is how much data the user can upload and the backing of a cloud storage data lake. These differences in products give all users an experience on both the desktop and web version to be shared with others inside or outside of their organization (Pricing and product comparison). When sharing with others, it is important to note that public reports and dashboards can be viewed by anyone. They do not have to have a Power BI account in order to view or interact with public reports (MaggiesMSFT).

### **Installing the Desktop**

In order to build a dashboard or report, the user will first need to install the Power BI Desktop to their device. This product can be found in the Microsoft store. To start the installation process, search “Power BI Desktop” once in the Microsoft store. Installing this product is free. Follow the prompts to fully install the product. At this point, you will need to either log into your paid account or create an account before starting the next step.

### **Uploading Data**

After downloading and installing the Power BI Desktop, the user can start to upload data. This step is important in understanding where the user will be getting data from. Data can be either uploaded in a flat or dynamic fashion. Flat data will be easier to validate but will not give the user live data without adding manual steps every time users want to update the data.

Dynamic data can be a better long-term solution for the user's intentions of the report. Power BI connects with other programs like; Azure Cloud platform, Online Services, SQL Database, files on Sharepoint, or Salesforce (Power BI – Supported data sources). Depending on the platform and Power BI product you have, there are some limitations on how many rows of data you can extract or push to Power BI. A common limitation with working in Power BI Pro is a 1000 row limit when pulling in data from online services. This limitation doesn't exist if this data is pulled from a flat file (Power BI - Support).

This guide will show the user how to upload data from a flat excel file. To upload data, the user will click on the “Get Data” option on the start screen after opening the application (See Figure 5).



*Figure 5. Power BI Desktop Homepage*

In the case of this guide, we will click on the excel file and click connect (see Figure 6).

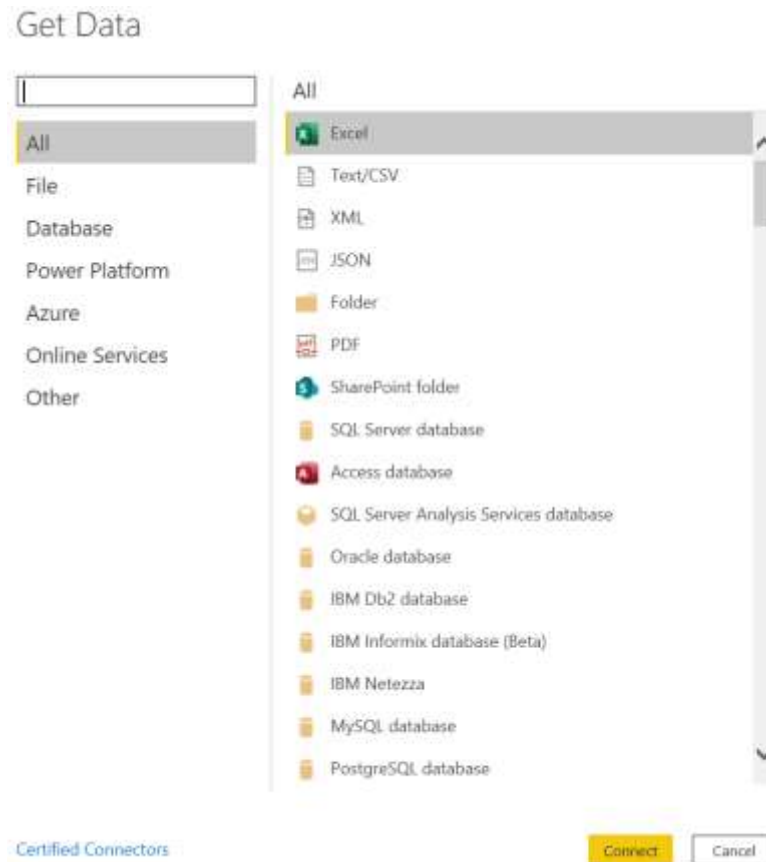
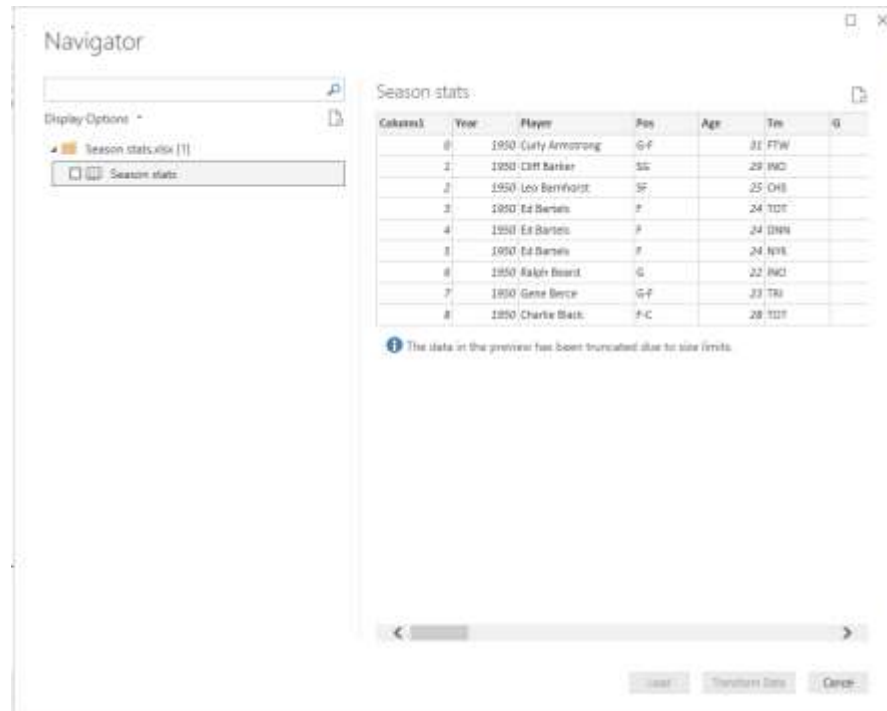


Figure 6. Getting Data into Power BI

Prior to this step, you will need to have saved your data in an excel format. Locate the saved excel file on your computer and click the 'transform data' button to start uploading the data into the Power BI Desktop.



Navigator

Display Options

- Season stats.xlsx (1)
- Season stats

Season stats

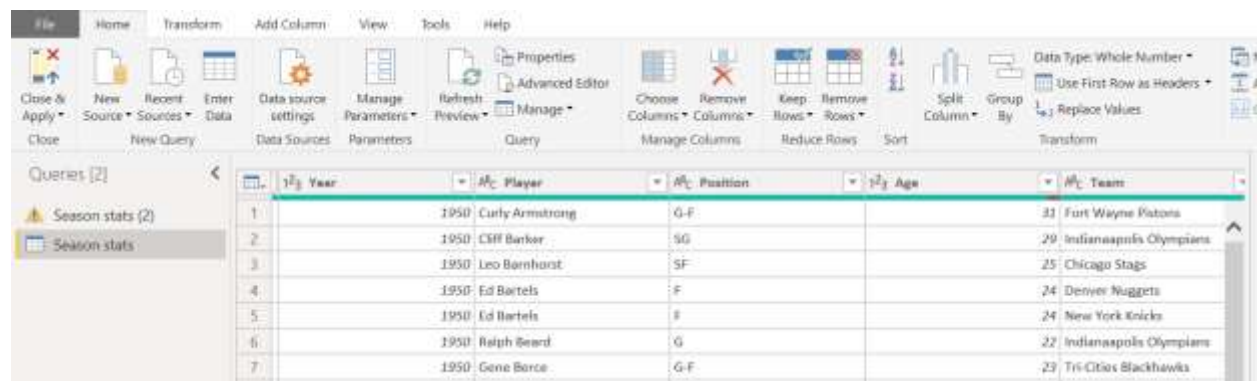
Column1	Year	Player	Pos	Age	Tm	G
0	1950	Curly Armstrong	G-F	31	FTW	
1	1950	CSH Barker	SG	29	IND	
2	1950	Leo Barnhorst	SF	25	CHI	
3	1950	Ed Bartels	F	24	TOT	
4	1950	Ed Bartels	F	24	DEN	
5	1950	Ed Bartels	F	24	NYK	
6	1950	Ralph Beard	G	22	IND	
7	1950	Gene Borce	G-F	23	TRI	
8	1950	Charlie Black	F-C	28	TOT	

The data in the preview has been truncated due to size limits.

Load Transform Data Cancel

Figure 7. Example Data before Transformation

Following these steps, the Query Editor will open (see Figure 8). If the Query Editor does not appear, under the home tab, click the ‘transform data’ button.



File Home Transform Add Column View Tools Help

Close & Apply New Source Recent Sources Enter Data Data source settings Manage Parameters Refresh Preview Properties Advanced Editor Choose Columns Remove Columns Keep Rows Remove Rows Split Column Group By Data Type: Whole Number Use First Row as Headers Replace Values

Queries [2]

- Season stats (2)
- Season stats

	Year	Player	Position	Age	Team
1	1950	Curly Armstrong	G-F		Fort Wayne Pistons
2	1950	CSH Barker	SG		Indianapolis Olympians
3	1950	Leo Barnhorst	SF		Chicago Stags
4	1950	Ed Bartels	F		Denver Nuggets
5	1950	Ed Bartels	F		New York Knicks
6	1950	Ralph Beard	G		Indianapolis Olympians
7	1950	Gene Borce	G-F		Tri-Cities Blackhawks

Figure 8. Query Editor Example

## Normalizing data in the Query Editor

The Query Editor is made to normalize a data set to create a better experience in creating visuals later (Getting started with query editor). This step will create the largest changes when creating a dashboard. Query Editor has many functions, like adjusting column headers, adjusting the data type, applying steps or merging or appending queries. This guide walks through four of the most used functions which will decrease the number of future steps to make the build process simpler.

### Column Headers

Changing column headers to something more recognizable by the users will ease possible confusion later in this process.

- To rename a column header, double click on the column. The column text should then be highlighted and text will be able to be edited (see Figure 9).

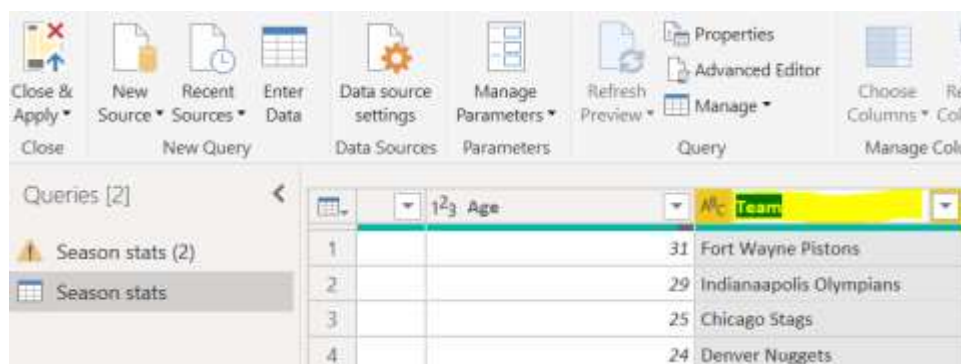


Figure 9. Editing Column Headings

### Data Types

The data type is a format option that identifies how the software will read the cell contents. In the example of using player and team data in the NBA, the age field will have to display as a whole number versus the default text option. When using quantitative data on the x and y axis on graphs, the data type will have to be in numerical or date form. This step will help the user when creating visuals as explained later in this guide.

- Change the data type by clicking on the data type icon in each column. Figure 10 below highlights how to change the data type (see highlighted box for types of data format).

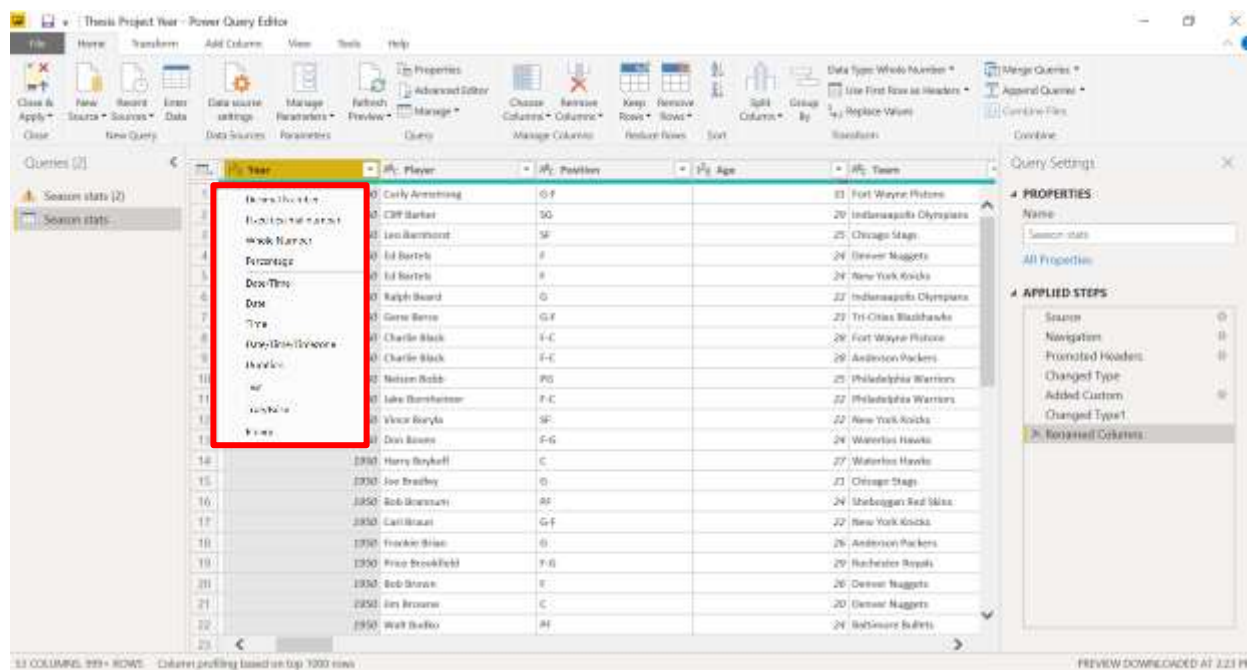


Figure 10. Changing the Data Type

### Applied Steps

The applied steps to the right of the screen in Query Editor is an excellent tool that tracks all changes to the data set (see Figure 11). To rename these steps to terms the user will know, right click on the preferred step and selecting the rename option. This helps the user and possible future users know what steps were made in compiling the report.

Applied steps is also a great tool to keep all the progress on the existing project if the same data set is saved in a new destination on the computer. In some cases of using flat reports, rows are added or cells are changed in the external excel dataset and need to be properly

reflected in the Power BI setting. As long as the column headers have not changed from the old upload to the new upload, using the ‘Source’ applied steps will update the data set.

- To change where the data is rooted from, double click the ‘source’ button to open the below prompt box. Then browse your computer for the new file’s destination and click the ‘ok’ button to allow Power BI to load the updated file. It is important to note that this will replace the existing data sets the user is adding.



Figure 11. Applied Steps – Tracking Edits

### *Merge and Append Queries*

Visuals can also be created that pull data from multiple data sets. Merging and appending queries these multiple data sets are used in two different scenarios. If the user wants to combine columns, use the merge queries function. Whereas, if the user wants to add rows to an existing data set, then use append queries (Iseminger). See the below steps and figures on how to merge and append queries:

- To add additional data sets, the user will need to save and close the Query Editor and click on the ‘get data’ button on the home page highlighted in Figure 12.



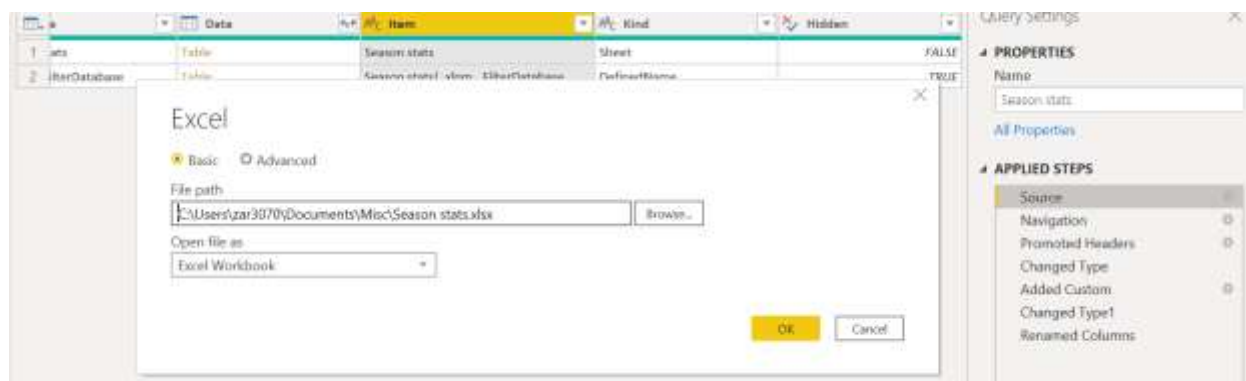


Figure 12. Adding Additional Data

- Once the data sets needed for the report are in Power BI desktop, in the home tab, click on transform data to pull back up the Query Editor (see Figure 13).

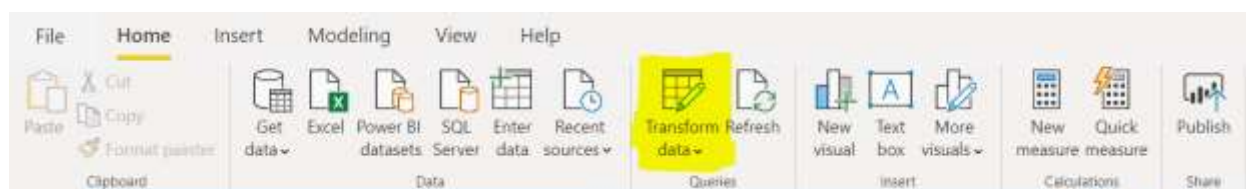


Figure 13. Transforming Data to Append

- To merge queries in the query editor, select 'Merge Queries' and 'Merge Queries as New' on the home tab (see Figure 14).



Figure 14. Merging Queries

- When the prompt box shown below populates, the user will select what two data sets they want to merge. To properly merge two data sets, there needs to be one common column between both files. These columns also need to have unique cell contents that are not duplicated in another cell in that column. An example of what would not qualify as good columns is if cell A4 in one data set, has the same contents as cell A30 in the same data set. In this case, the merge field will not work properly. Examples of good columns to



merge are identification numbers, phone numbers, or names. See Figure 15 below on how to merge two data sets that relate to the NBA.

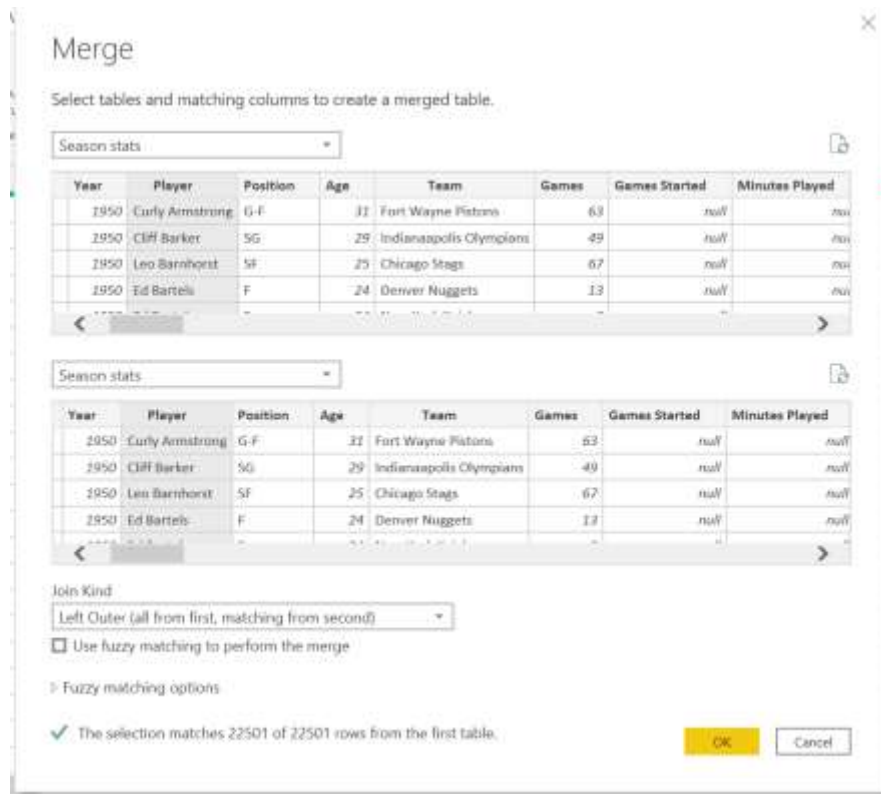


Figure 15. Example of Merging Two Data Sets

To append data sets, users will follow similar guidelines.

- The user will select 'append queries' and then 'append queries as new' on the home tab.
- Then a prompt box will appear (see Figure 16). Set the 'primary table' as the master table that will get added to. Set the 'table to append to the primary table' from the file that has additional rows that will get added to the primary table.

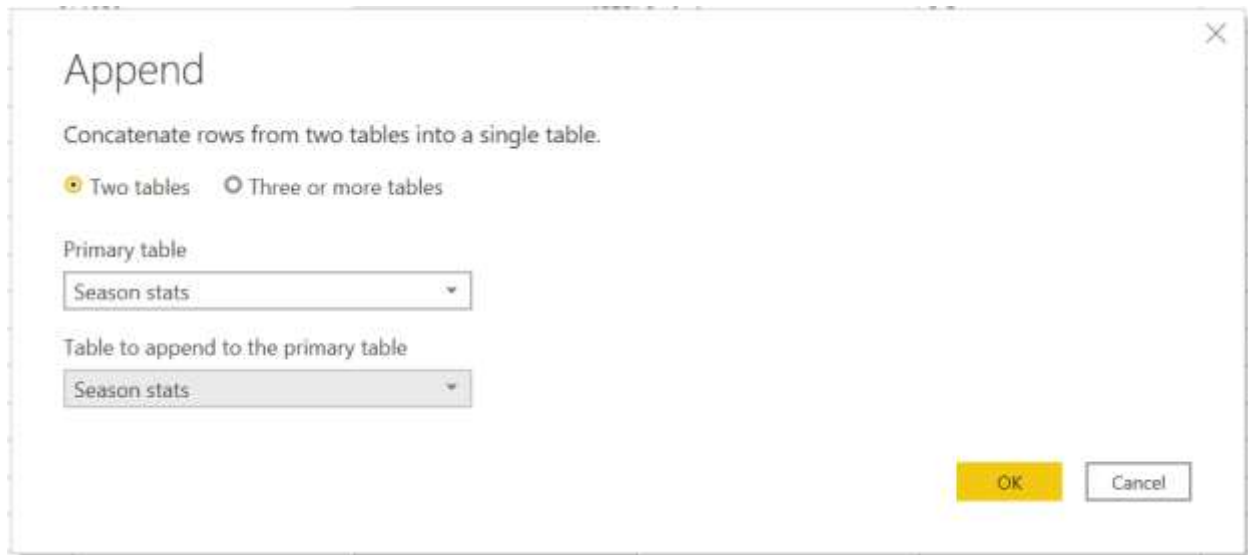


Figure 16. Prompt Box

- To exit the query editor, click the apply and close button as displayed in Figure 17.

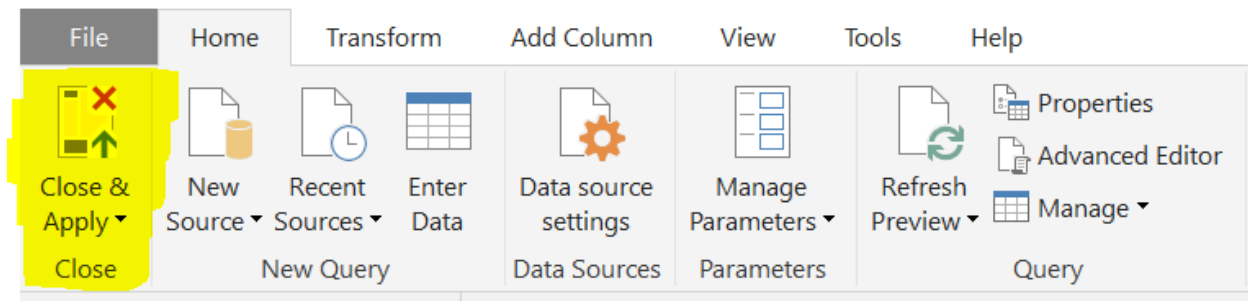


Figure 17. Exiting the Query Editor

Normalizing the data in the query editor is the largest step in this process. Spending extra time in this process will make the build much easier when it comes to it. Now that the data is ready to work, the user can start to build the visuals.

## Making a Visual

In Power BI Desktop there are 33 visual types to choose from. There is also an AppSource to purchase and download free visuals. In this guide, there will be one visual that is used through the AppSource to provide an example of how to use visuals in the AppSource.

### *Chiclet Slicer*

The Chiclet Slicer visual is not one of the default visuals and needs to be downloaded for free from the AppSource. This visual is made to filter down a report when the user clicks on the buttons that appear (Chiclet slicer). One of the advantages of this visual is the ability for users to select specific fields that will filter out the entire report. This filter will remain unchanged for every other visual generated in the dashboard making the dashboard more dynamic and interactive. In the case of this guide, the Chiclet Slicer was added to allow the user to click on a single or multiple players or team(s) to filter into the rest of the dashboard to display only data that is tied to that player or team. Other examples of using the Chiclet Slicer is to filter even different sales divisions, or brands in a portfolio to single out specific data by field.

Importing from AppSource:

- Access the AppSource by clicking on the horizontal ellipsis in the visualizations pane. Select 'Import from AppSource'.

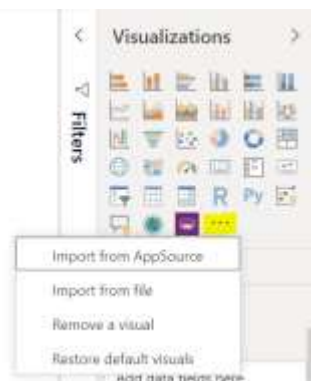


Figure 18. Downloading the Chiclet Slicer

- Scroll through or search for any visual. In the case of this guide, the search option is filled in 'Chiclet Slicer' so that visual can be added. Click 'add' next to the visual.

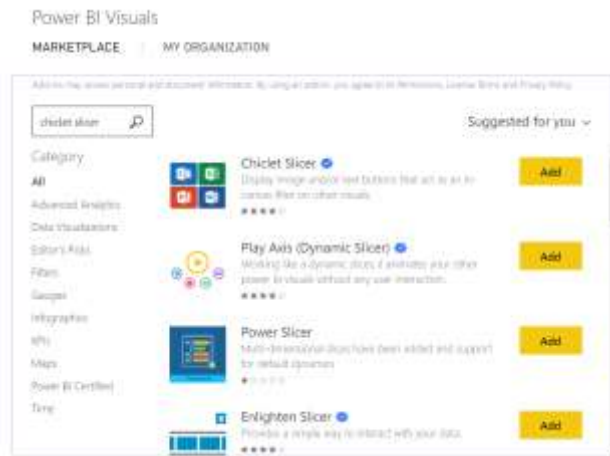


Figure 19. Adding the Chiclet Slicer

#### Inserting the Chiclet Slicer to the dashboard

- Click on the Chiclet visual in the visualizations pane and input the player field found in the field pane in the category.

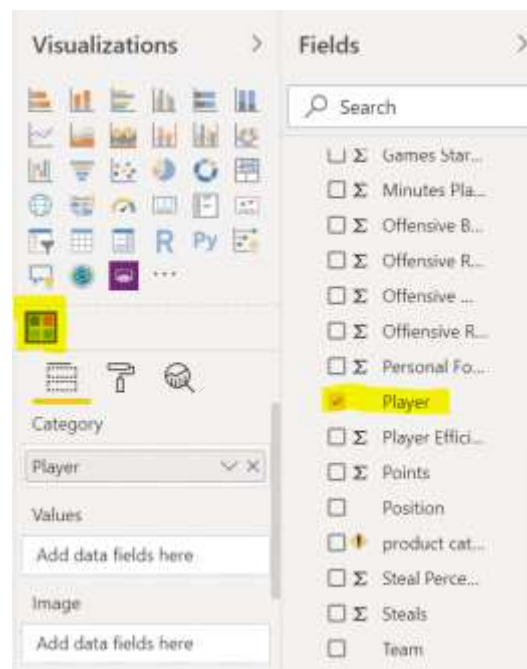


Figure 20. Adding the Chicklet Slicer to the Dashboard

The visual should appear similar to Figure 21. To see how to display the visual better, see the ‘Editing for Display’ section of the guide.

A.C. Green	Blair Rasmussen	Chris Owens
A.J. Bramlett	Blake Ahearn	Chris Paul
A.J. English	Blake Griffin	Chris Porter
A.J. Guyton	Blue Edwards	Chris Quinn
A.J. Hammons	Bo Ellis	Chris Richard
A.J. Price	Bo Eriks	Chris Robinson
A.J. Wynder	Bo Kimble	Chris Singleton
A.W. Holt	Bo Lamar	Chris Smith
Aaron Brooks	Bo Outlaw	Chris Taft
Aaron Gordon	Bob Allen	Chris Washburn
Aaron Gray	Bob Anderegg	Chris Webber
Aaron Harrison	Bob Armstrong	Chris Welp
Aaron James	Bob Arzen	Chris Whitney
Aaron McKie	Bob Bigelow	Chris Wilcox
Aaron Miles	Bob Boozer	Chris Wright
Aaron Swinson	Bob Brannum	Christian Eyenga
Aaron Williams	Bob Brown	Christian Laettner
Abdul Jeelani	Bob Burrow	Christian Wood
Acie Earl	Bob Carney	Chubby Cox
Acie Law	Bob Carpenter	Chuck Aleksinas
Adam Harrington	Bob Carrington	Chuck Cooper
Adam Keefe	Bob Christian	Chuck Gilmur
Adam Morrison	Bob Cousy	Chuck Grigsby

Figure 21. Example of Editing for Display

## Slicer

A slicer is similar to the Chiclet Slicer but has less capabilities. The slicer sorts and filters dashboards to display only information in that range.

In terms of this guide looking at player and team data, the slicer was added to display a year range when players were in the NBA.

To add the slicer visual to the dashboard:

- Click on the slicer visual and input the year field in the field pane (see Figure 22).

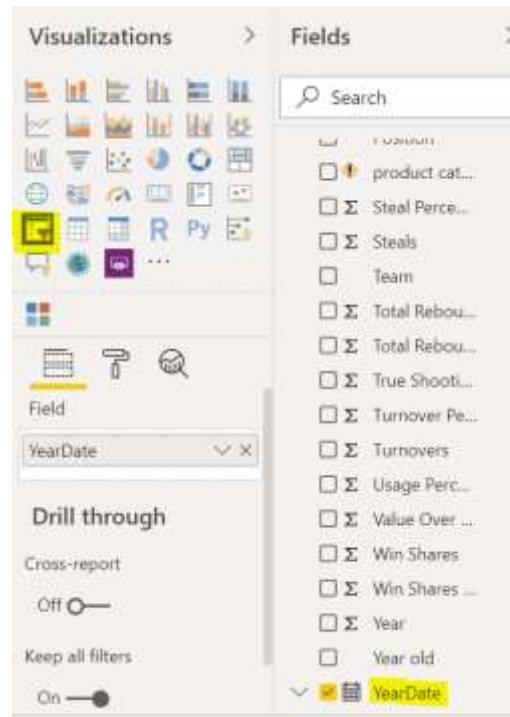
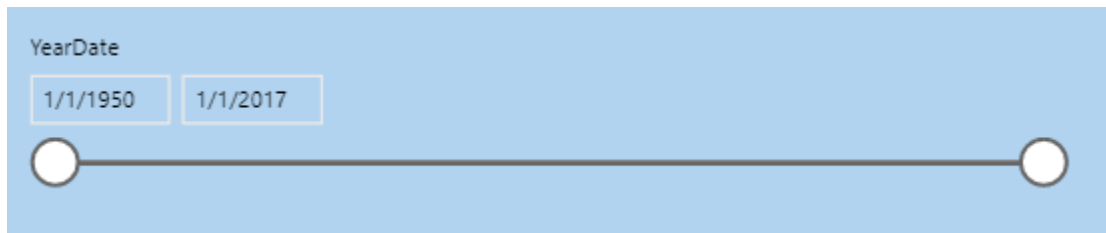


Figure 22. Slicer example using Year Range



### Table

The table visual is made to display multiple pre-selected columns of data in a single visual. A table is especially useful when the user wants more details or a drill through quantitative data (Mihart-table).

To create a table visual:

- Select the table visual and input the corresponding fields the user wants to see into values pane (see Figure 23).

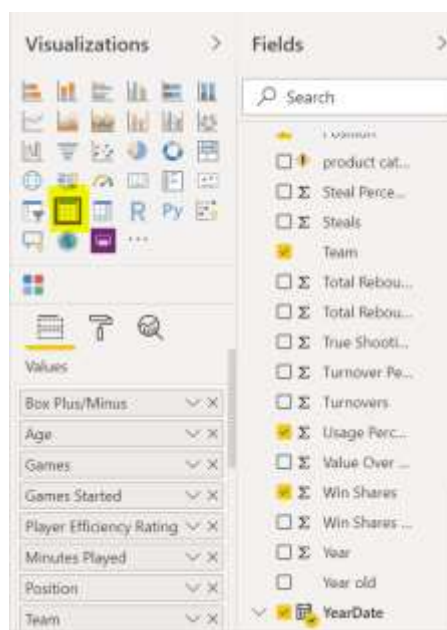


Figure 23. Table Visual Example

In terms of looking at NBA player and team data, the Figure 24 below shows an overview of different player stats after four players were selected using the Chiclet Slicer.

Box Plus/Minus	Age	Games	Games Started	Player Efficiency Rating	Minutes Played	Position	Team	Year	Usage Percentage	Win Shar
-4.90	34	30	0	5.00	308	SF	Los Angeles Clippers	2017	13.70	0.
-2.80	33	13	0	9.20	192	SG	Washington Wizards	2016	15.40	0.
-0.50	32	74	19	10.60	1744	SG	Brooklyn Nets	2015	14.20	2.
-2.20	31	78	26	9.50	1773	SF	Brooklyn Nets	2014	15.90	1.
-2.00	30	65	2	12.60	1495	SF	Toronto Raptors	2013	23.60	1.
-3.40	29	17	12	8.70	461	SF	Toronto Raptors	2012	18.60	0.
-0.10	29	36	13	11.80	644	SF	Minnesota Timberwolves	2013	11.50	1.
-4.00	24	17	0	10.10	256	SG	Charlotte Bobcats	2007	20.10	0.
-3.60	24	39	0	10.50	465	SG	Seattle SuperSonics	2008	17.90	0.
<b>Total</b>	<b>460</b>	<b>857</b>			<b>17529</b>					<b>22.</b>

Figure 24. Applied Example

### Clustered Bar and Column Chart

These visuals are designed to show quantitative data that displays values on the x-axis and is grouped by data on the y-axis (Introduction to Power BI visuals).

To choose the clustered bar or column charts:

- Select that graph in the visualization and input the axis with data and the value with the group of data you want to represent. Figures 25 and 26 below represent the total rebounds by year of a single player in the NBA.

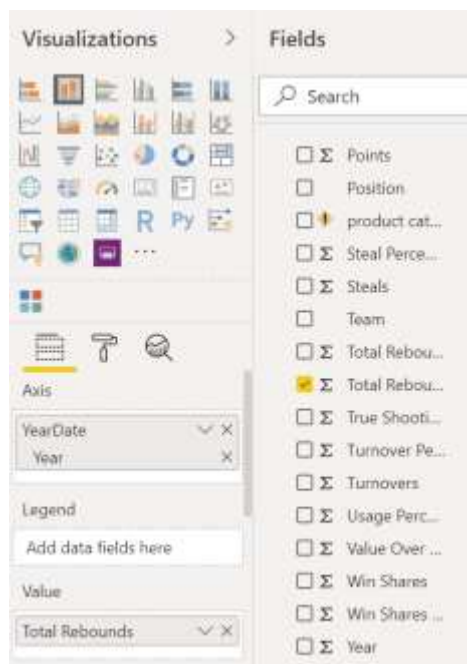


Figure 25. Generating the table for Total Rebounds by Year

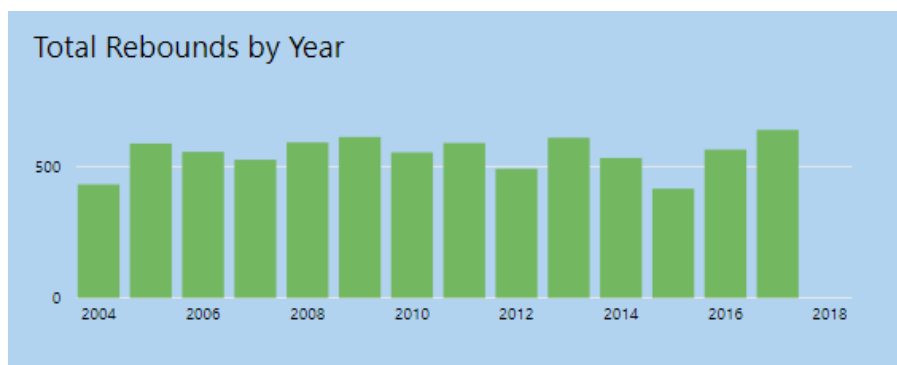


Figure 26. Example of Clustered Bar

### Pie Chart

The pie chart represents percentages and parts to the whole (Create a power BI pie chart).

To create a pie chart:



- Click on the pie chart visualization and input the values you want to represent from the fields. Figures 27 and 28 below show single player's all-time shooting percentage based on free throws, 2-pointers, and 3-pointers.

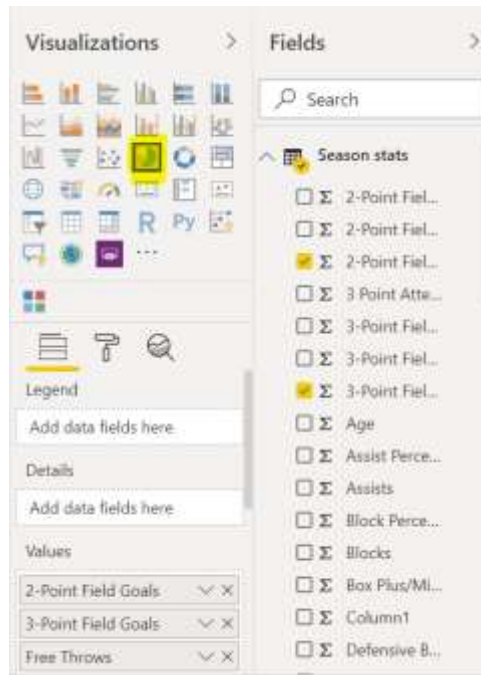


Figure 27. Selecting the Data

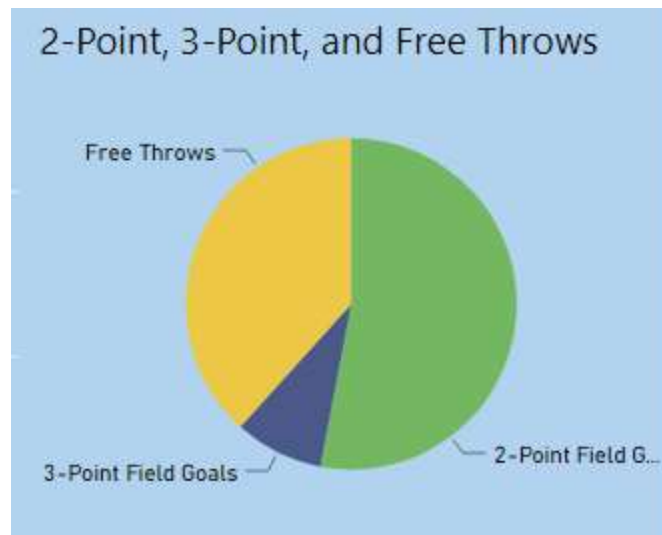


Figure 28. Pie Chart Results

### Area chart

The area chart is used to show the area that is used between the axis and line to (Mihart-Area chart). The area chart is a good visual to show trends over time and to see quick outliers.

To add in the area chart visualization

- Click on the chart in visualizations and input a quantitative value on the axis and add the data points to be shown on the chart in the value field. See Figure 29 and 30 as the area chart is used to show how the player efficiency rating and usage percentage stack up year or year for an NBA player.

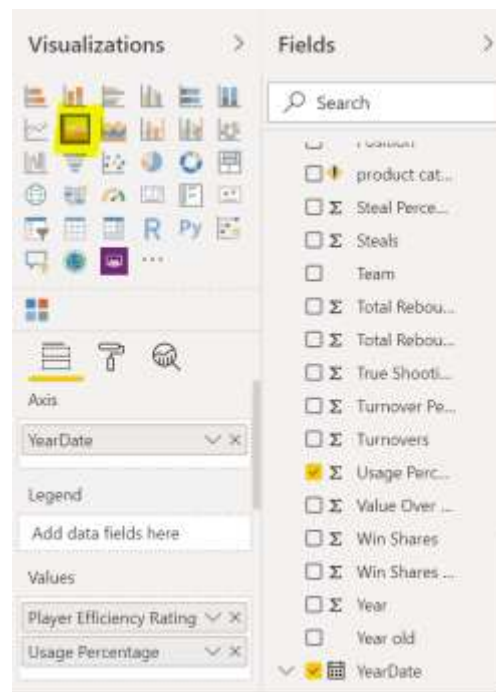


Figure 29. Selecting the Fields for the Area Chart

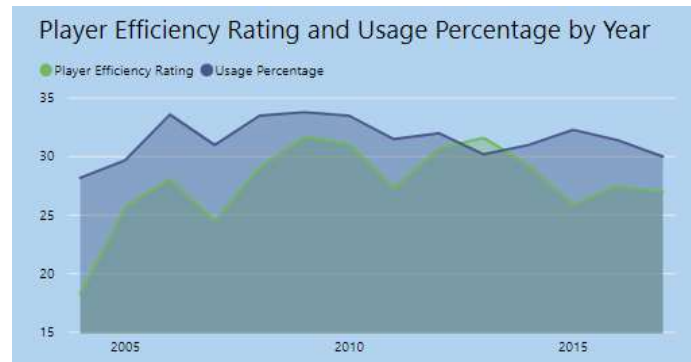


Figure 30. Example of Area Chart

### Funnel

The funnel chart shows a linear approach to a data set that occurs sequentially (Mihart Funnel Chart). This chart can also show the steps taken to reach 100%.

In order to create a funnel chart:

- Select the funnel chart in the visualization tab and select values that create sequential steps. Figures 31 and 32 below show how many blocks and steals a single player has gotten in their career through the funnel chart.

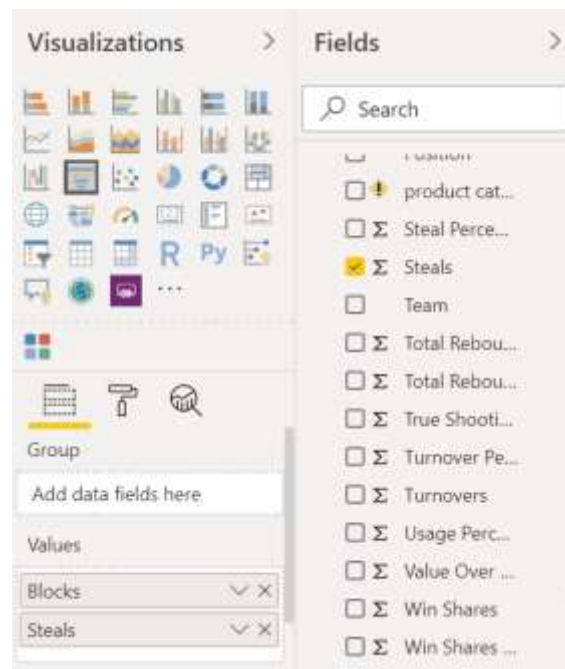


Figure 31. Selecting the Fields for Funnel Chart

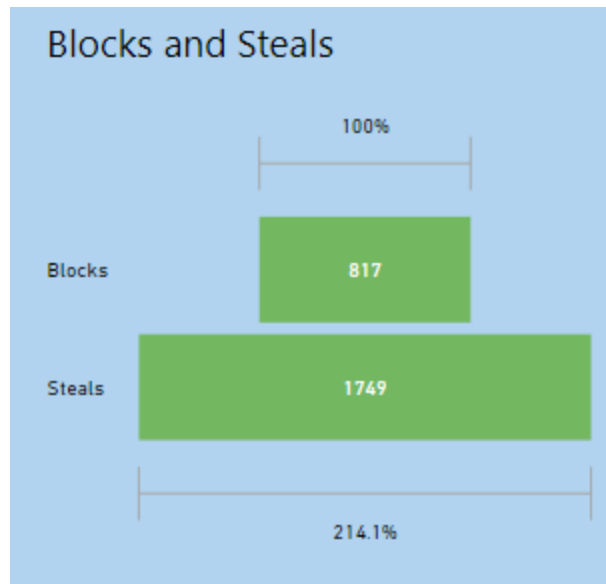


Figure 32. Example of Funnel Chart

### Card

The card is used to show a single number. This can be used a totals or goal setters (Mihart Visualization card).

To show the single number through a card:

- Select the card visual and input a single field in the value option. Click on the down arrow to the right of the field to show the different options on what number can be shown. The field can show; counts, sums, averages, minimums, maximums, or standard deviation from a column. Figures 33 and 34 below card shows the count of seasons played by a single player.

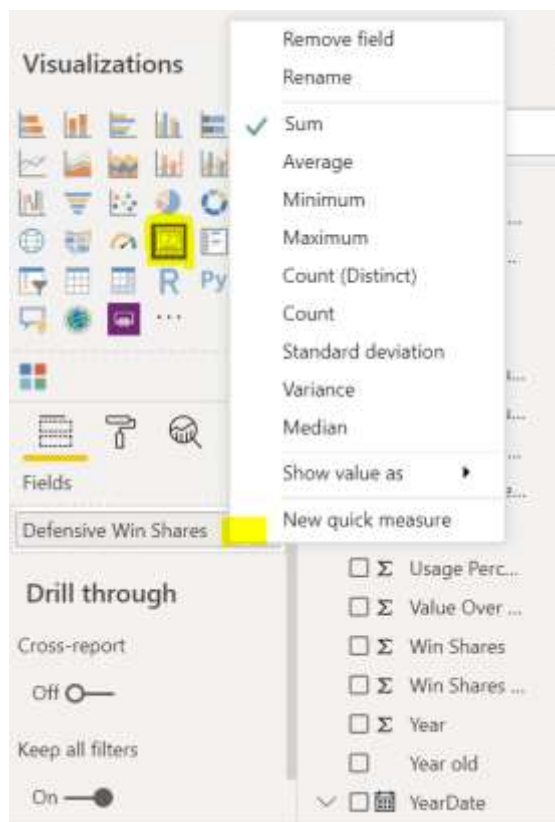


Figure 33. Field Selection for Card Chart

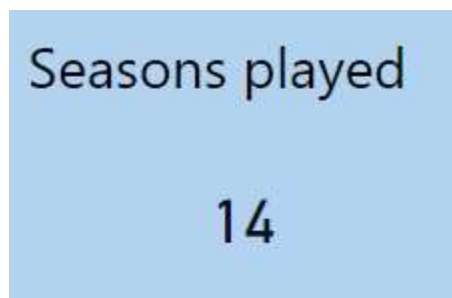


Figure 34. Example of Card Chart

### *Multi Row Card*

In some cases, showing a groups values in a list view is most beneficial. The multi row card will visually represent this (Create a multi-row card).

In order to create a multi row card:

- Select the multi row card icon in the visualizations pane. Input the value you want to represent in the fields section of the visualizations pane. The guided dashboard shows

what teams the selected player has played on throughout their career (see Figure 35 and 36).

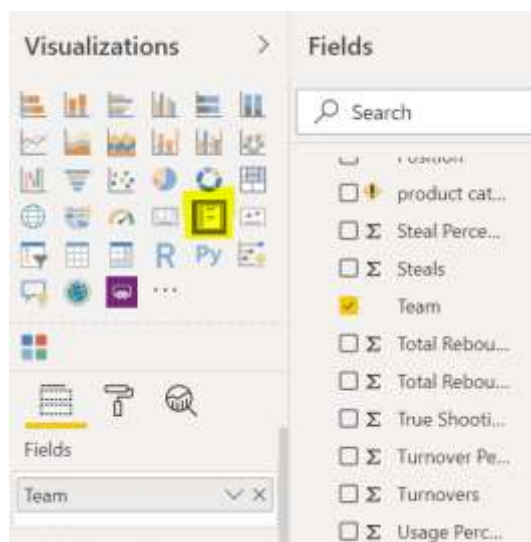


Figure 35. Field Selection for the Multi Row Card

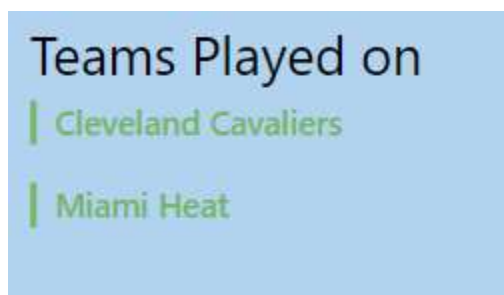


Figure 36. Example of Multi Row Card

There are many other visuals to help show the data set in a visually appealing way. The visuals outlined in this guide show the most common visuals used for a beginner skillset.

## Editing for Display

Now that all of the visuals are displaying graphs and cards, visual editing can be made to enhance the user experience to make the dashboard more ascetically pleasing.

To edit the entire report:

- Add a theme to the dashboard. This can be done by going to the ‘view’ tab and selecting on of the many themes to choose from (see Figure 37).

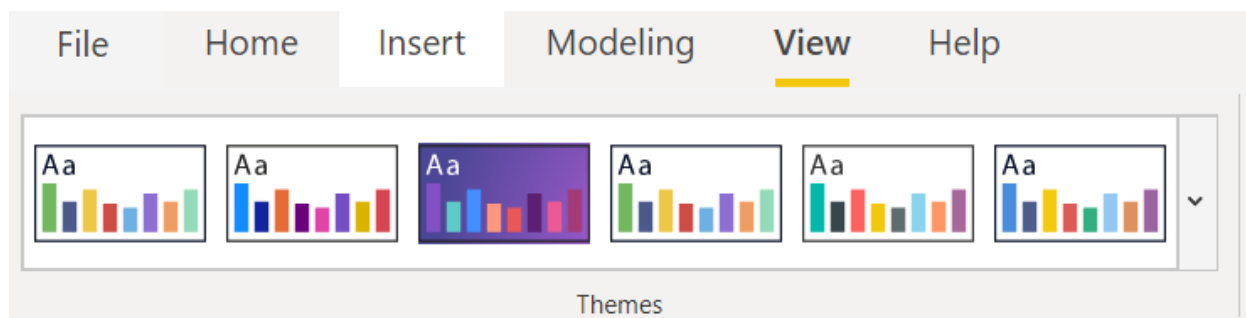


Figure 37. Selecting a Theme

One of the quickest ways to create better visuals is to delete category headers and add titles to cards and graphs. Before editing, Figure 38 shows what a card looks like.



Figure 38. Pre-editing Example of Card

To make edits to remove this category header and add a title:

- Click on a visual and go to the format tab on the visualizations pane (see Figure 39).

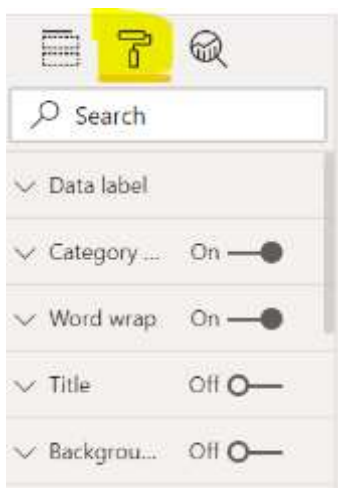


Figure 39. Editing a Card for Display

- Turn the category header off. Turn on the title to type in a title. Format with an appropriate font, size, and color to match the theme of the rest of the report. After the edits, the visual could appear like the visual in Figure 40.



Figure 40. Example of Card Edited for Display

On graphs, the x and y axis can be edited to display the values by continuous and categorical ranges. Continuous is the default setting and will show all of the values in that data range, even if there is no value to be shown on that point on the axis. The x and y axis also have the ability to change font, size, and color of the values as shown in Figure 41.





Figure 41. Formatting the X and Y Axis

When creating a dashboard, spending time on the look and feel of the dashboard will help the users not only see and understand the data more accurately, but the edits will make the dashboard look that more professional and fitting to any organization.

## Filters

There are different ways filters can be attached to the dashboard. The user can select if a filter can be applied to a single visual, just the page, or all pages of the report. To do this open the filter pane in the Power BI Desktop and drag over a field to filter.

In our example below (Figures 42 and 43), a visual filter was added to the 'Personal Fouls by Games' visual to represent only the last 25 games of the players career.

To add this filter:

- Click on the games field in the visual filters tab, selected advanced filter. Choose 'is greater than or equal to' in the dropdown. Insert '25' in the value field. This will then filter the graph to show only the last 25 games of the player's career. The filter will not show the first 60 games of their NBA career.

Filters on this visual ...

Games ^

is (All) 🔍

Filter type ⓘ

Advanced filtering ▼

Show items when the value:

is greater than or equal to ▼

25

☒ And ☐ Or

▼

▼

Apply filter

Figure 42. Example of Creating Filters

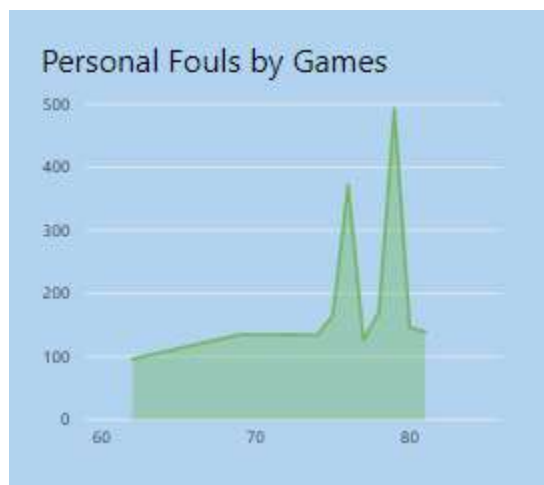


Figure 43. Example of Filter Display

## Publishing and Sharing

Once the Power BI Desktop is completed and ready for other users to see it, the dashboard can be published to the Power BI Web version.

To publish the finished product:

- Go to the home tab. Click the publish button to the right of the screen. Click on the 'my workspace' option and click 'select' (see Figure 44).

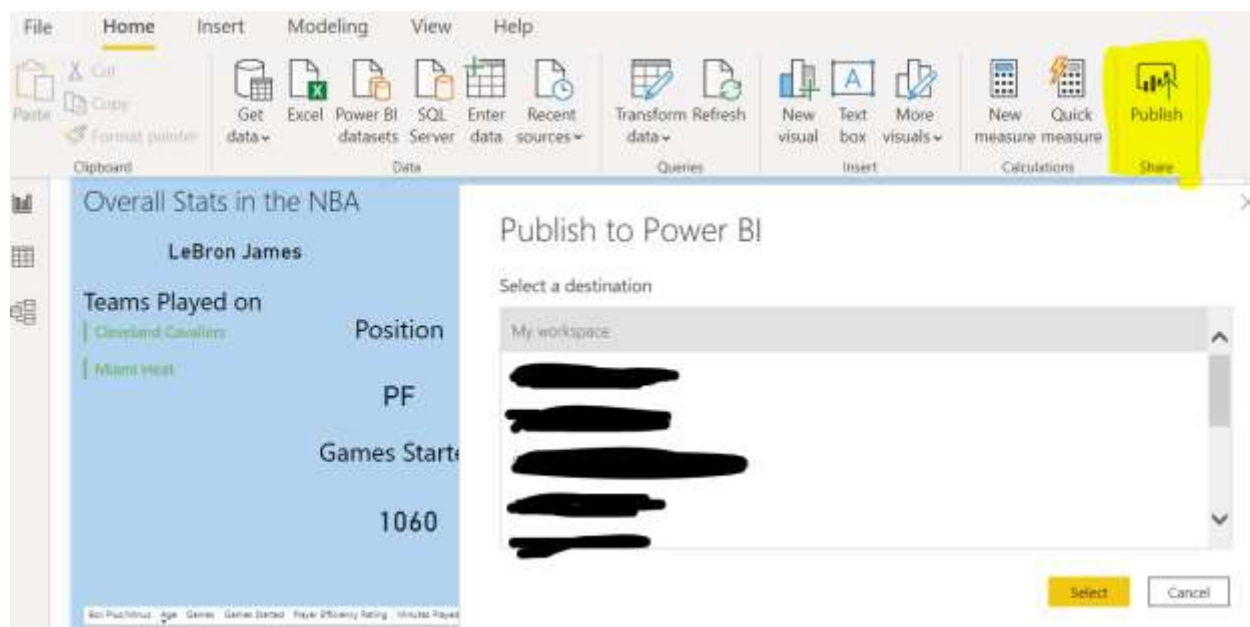


Figure 44. Publishing Power BI

The success text box should then pop up and give the user to either open the dashboard in the web version or go back to the desktop version by selecting the 'got it' button (see Figure 45).

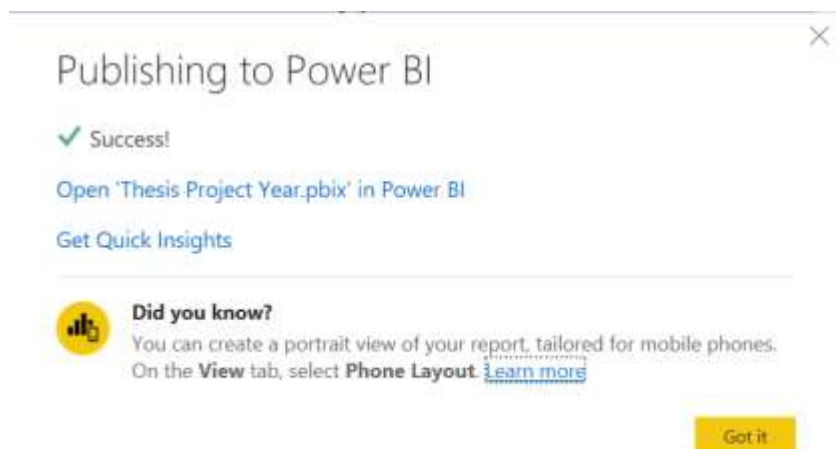


Figure 45. Completion of Publishing Power BI

The web version of Power BI is the location that other users and collaborators will see. The owner can create sharing permissions. The owner can input emails for those who can see the report and set limits of a viewer, editor, or collaborator (MaggiesMSFT Share).

## **CONCLUSION**

In conclusion, Power BI can be used for many projects to visually represent data. It is most often used to transform data to view operational efficiency of a company or department in business (What is Power BI). The guide outlined the basic steps that go into making a dashboard for projects and how to share the finished project with others. Correctly creating a dashboard while using this software for any organization will effectively communicate how the data in data sets are telling a story to the end consumer. This guide's goal was to introduce new users to the Power BI platform and give them the confidence to start building their own. New Power Bi users should now have a basic understanding and outline how to go about creating their own report.

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